

National Aeronautics and Space Administration



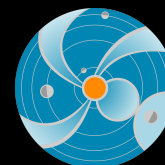
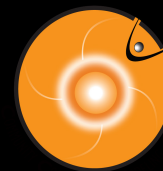
The Integrated Space Weather Analysis System

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Aknowledgement: Marlo Maddox

Space Weather REDI 2016

*[http://
iswa.ccmc.gsfc.nasa.gov](http://iswa.ccmc.gsfc.nasa.gov)*

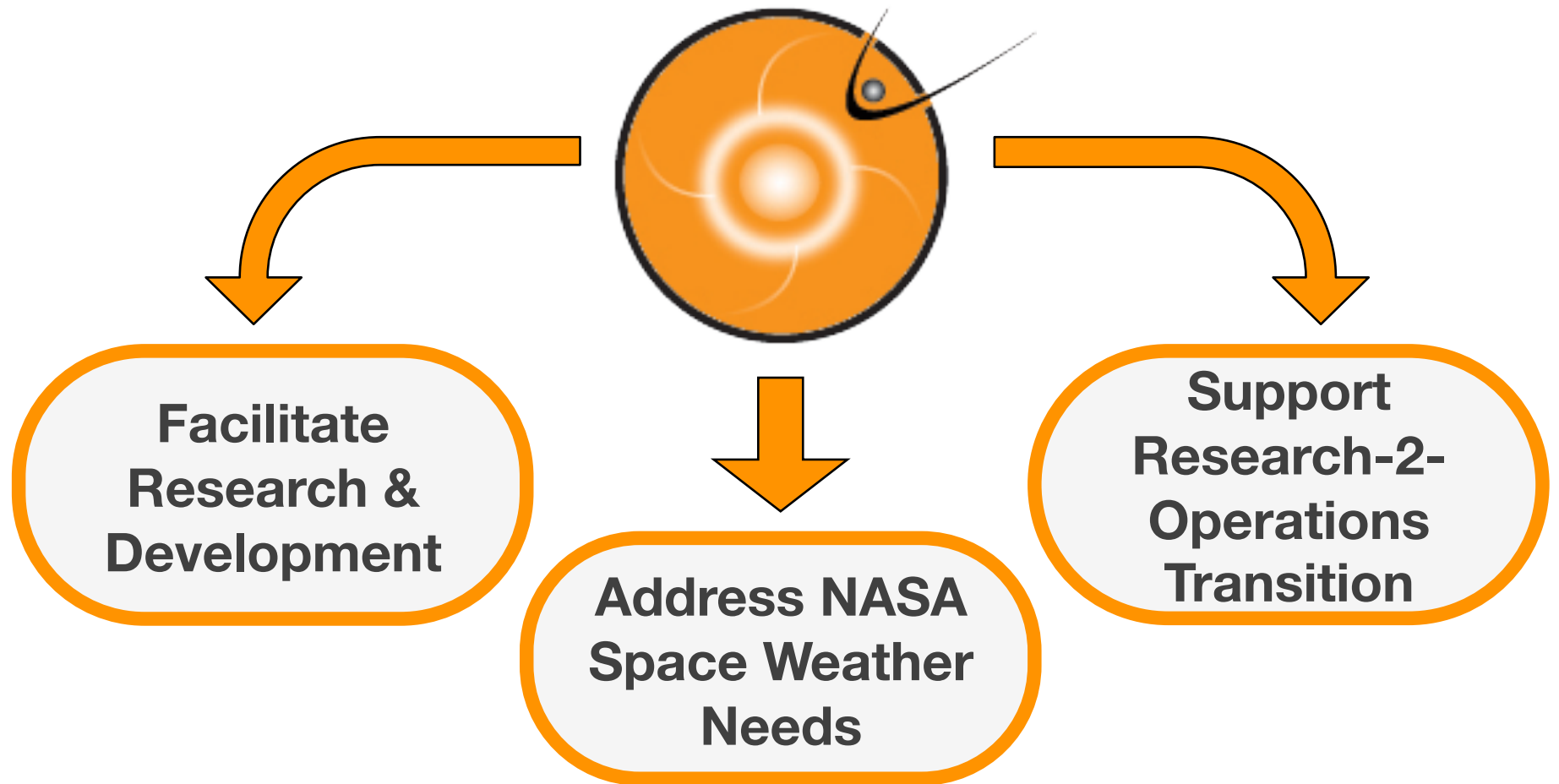
www.nasa.gov



How Do You Quickly Determine Past, Present, & Expected Space Weather Impacts?



CCMC Goals

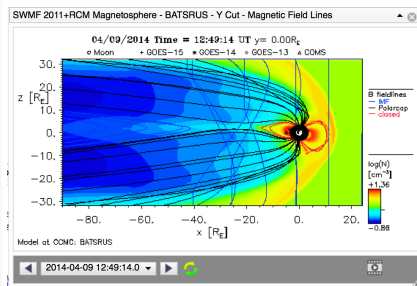


Core CCMC Partners: International Research Community, Model Owners, NASA Engineers and Mission Specialists, Operational Space Weather agencies (NOAA, DoD, UK Met Office).

CCMC Tools, Systems, & Databases

for Research, Analysis, Metrics & Validation, Forecasting

Continuous
Real-time
Simulations



Event-Triggered
Real-time
Simulations



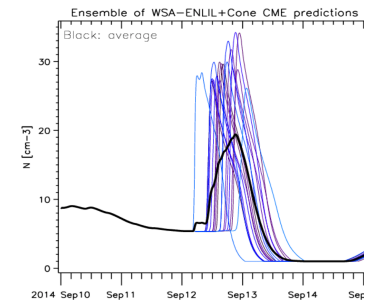
1-Click

Input
Parameters
Generation Tools



StereoCAT

Ensemble
Simulations



iNtegrated Space
Weather Analysis
System



Databases:
Run Results,
Events, Impacts
interpretations

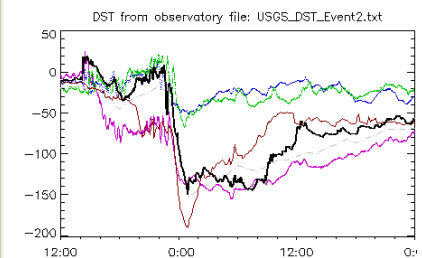


DONKI

Forecasting
Methods
ScoreBoards



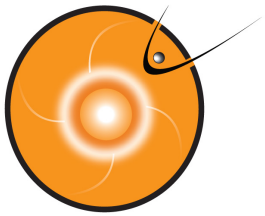
M&V Suite
to Trace Model
Improvements



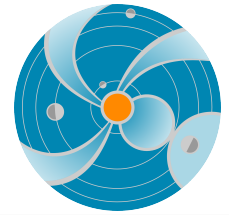


With so many NASA assets throughout the Heliosphere, the agency identified a critical need for the

Integrated Space Weather Analysis System

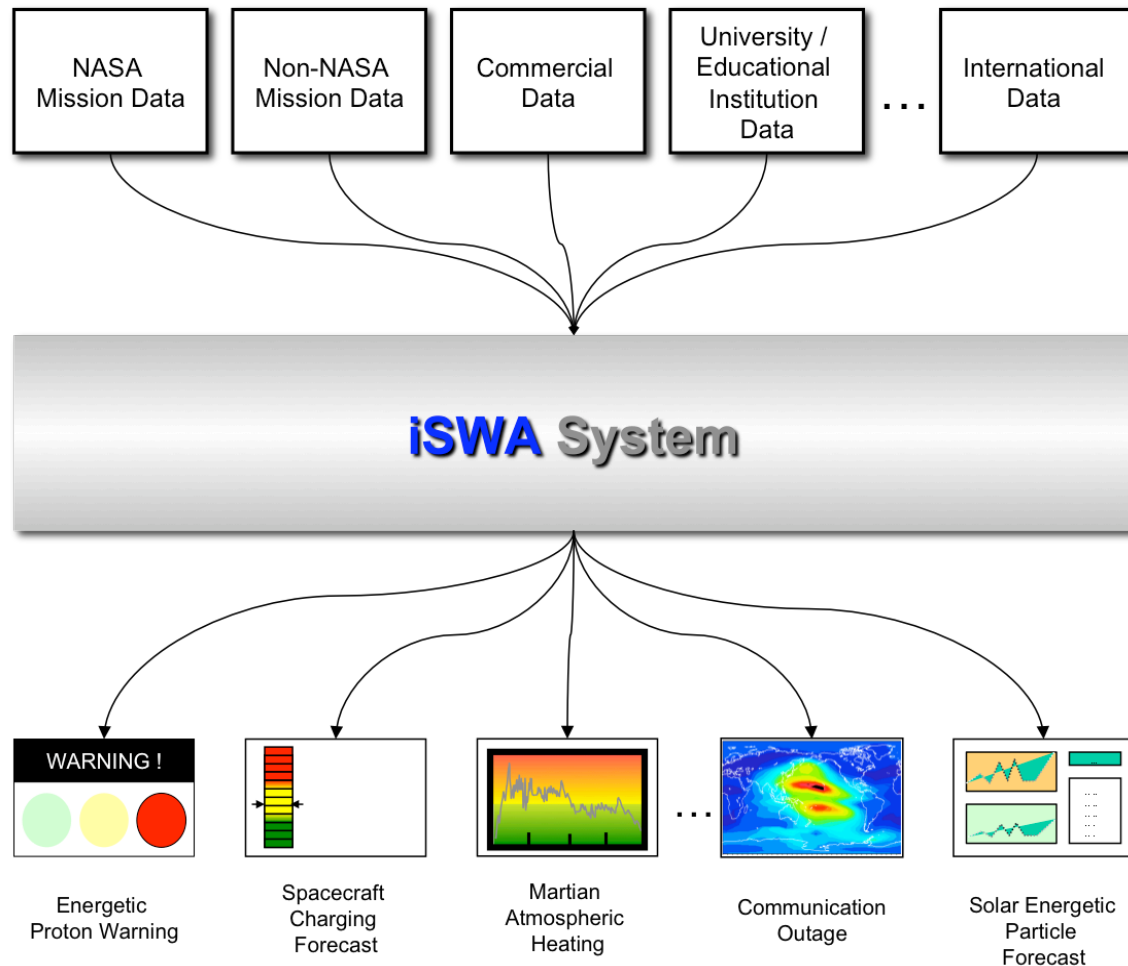


iSWA Solution & Deliverables



1. Acquire, ingest, and produce NASA relevant space weather information
2. Utilize both observational and simulation/model data
3. Produce and provide real-time data streams
4. Categorize and archive data for historical impact analysis
5. Provide customizable and highly configurable displays
6. Disseminate through the most widely deployed and accessible interface – the web

iNTEGRATED SPACE WEATHER ANALYSIS SYSTEM

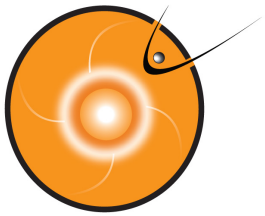


Highly diverse and distributed space weather data consisting of the latest observational data along with the most advanced space weather model simulation output.

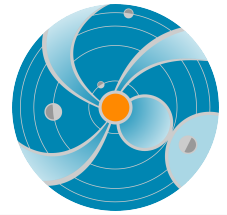
iSWA system collects data from a large and evolving list of sources. Data is sorted, characterized, and processed into 'mission decision supporting' products in response to individual user queries.

iSWA generates and provides a user-configurable display panel that can be accessed from a standard web browser. The end user can then customize their display to focus on specific products of interest.

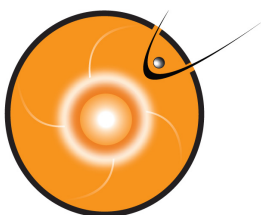
iNTEGRATED SPACE WEATHER ANALYSIS SYSTEM



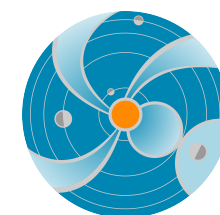
Data Management Challenges



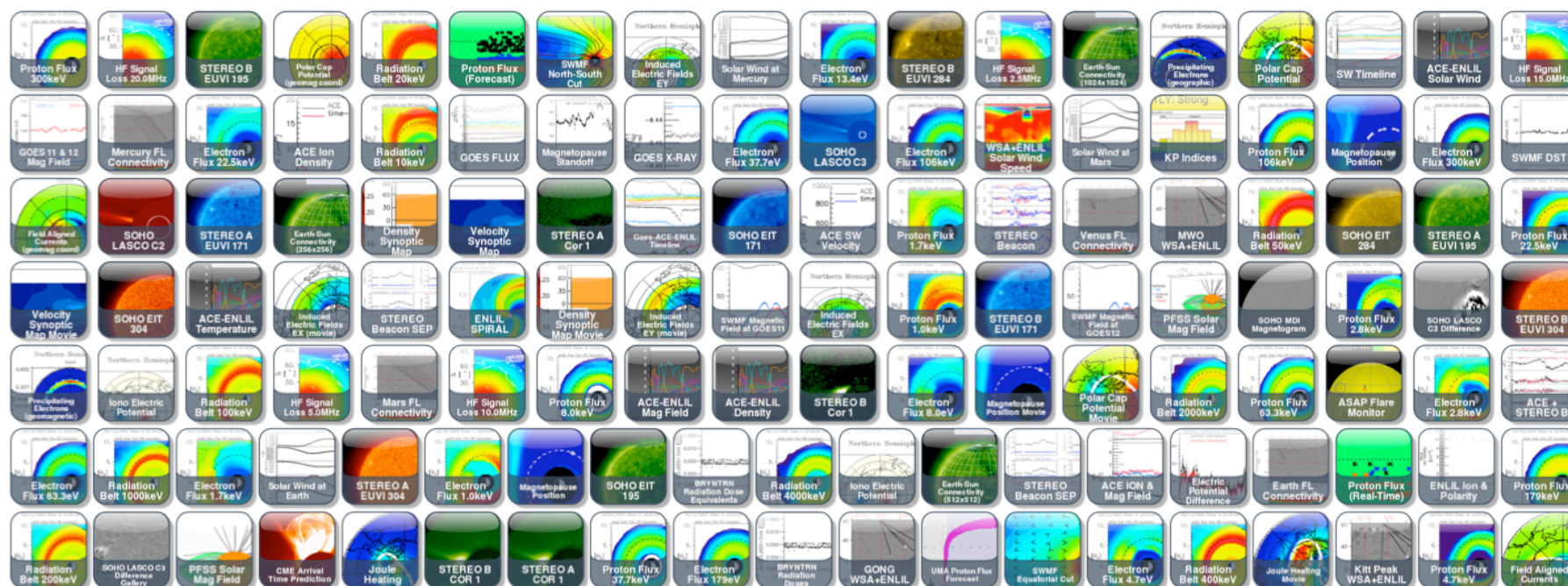
- Ingesting data streams from a variety of sources with varying:
 - Transfer Methods (push and pull)
 - Levels of availability
 - Access Protocols (http, ftp, scp, mv)
 - Naming Conventions
 - Update Intervals (efficient polling for new data)
 - Date & Time Stamp Formats i.e.
[2011-01-01_212500] or [2011-1-1_212500] or [20100101_212500] or
[2011_001_212500] or [2010_Jan_01_212500] or [latest] or...
- Sorting, Archiving, and Management
 - Persistent storage (file system or database)
 - Cataloging, How to keep track of what is where
 - Scalability, Additional storage
- Changes (urls, names, formats, extensions, etc.)



Innovative Dissemination



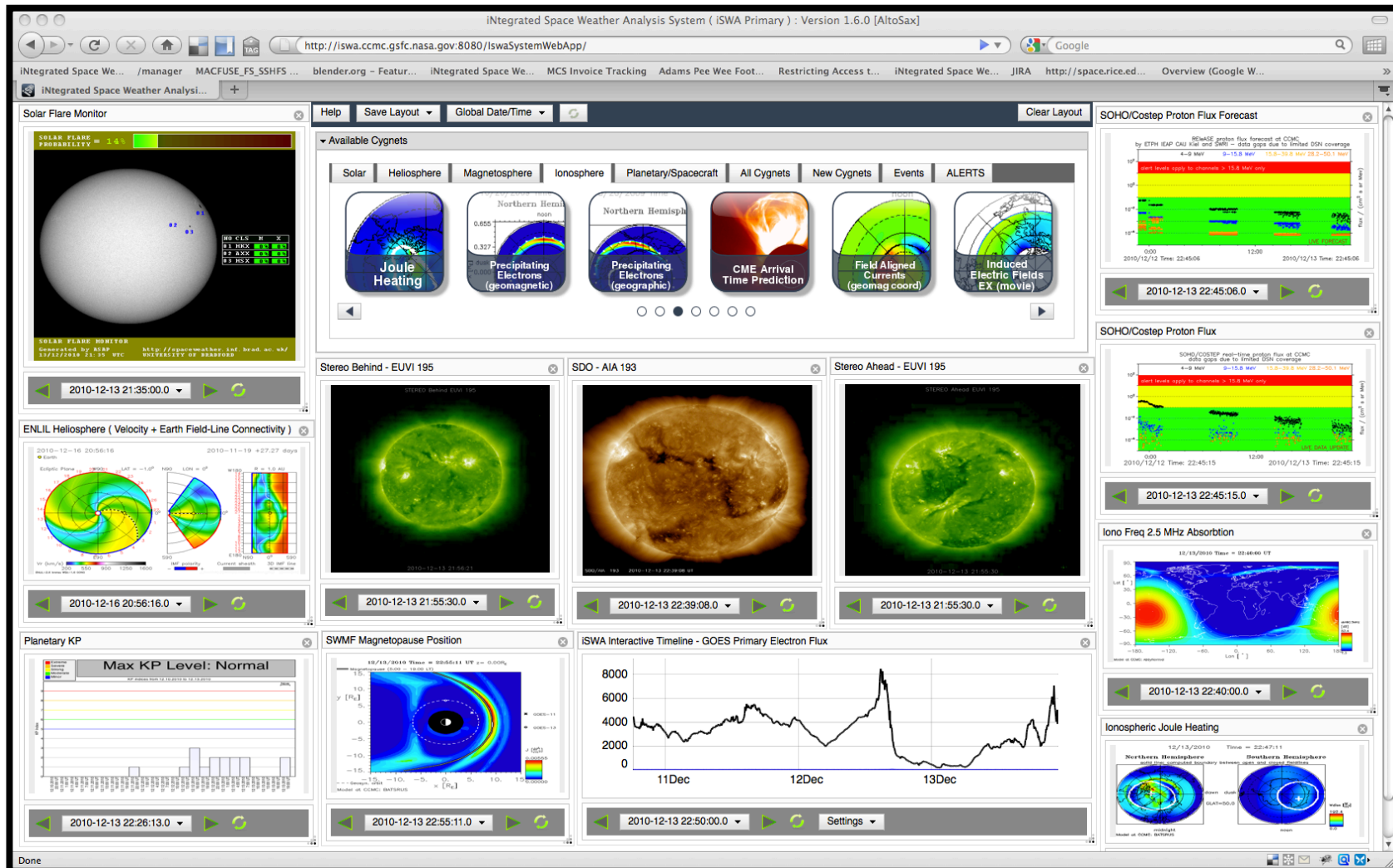
ISWA has ~300 products including modeling results and comprehensive sets of observational data.



Web-based. User configurable. Available world-wide.
One-stop shop for state-of-the-art information!
<http://iswa.gsfc.nasa.gov>



Unprecedented Access to Space Weather Information



<http://iSWA.ccmc.gsfc.nasa.gov>

Help Save Layout Global Date/Time **Layout & Global Controls** Clear Layout

Cygnets Control Panel

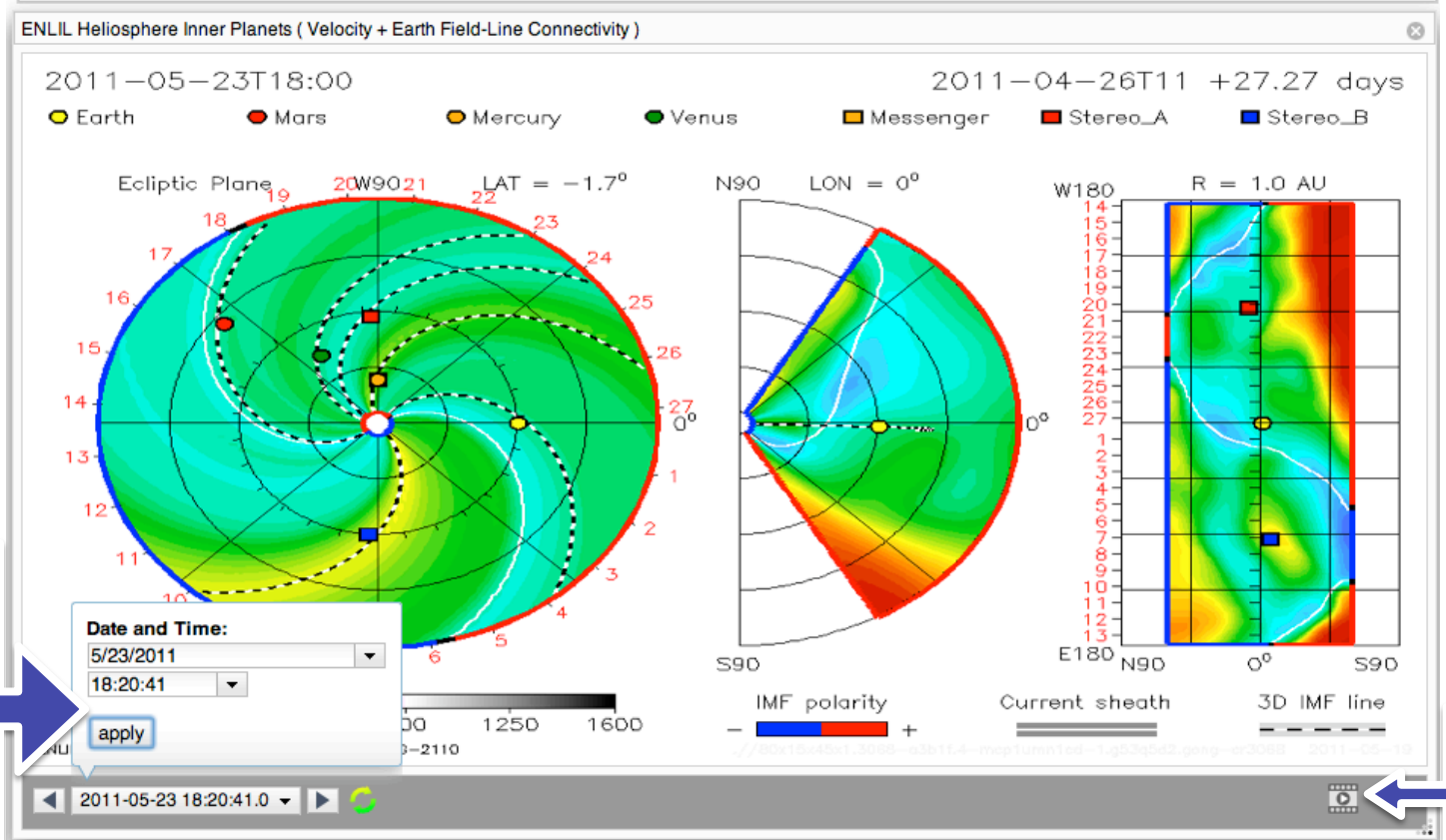
Available Cygnets

Solar Heliosphere Magnetosphere Ionosphere Planetary/Spacecraft All Cygnets New Cygnets Events ALERTS bETA

CME Arrival Time Prediction ASAP Flare Monitor UMA Proton Flux Forecast SOHO EIT 171 SOHO EIT 171 (NRL) SOHO EIT 195

1 2 3 4 5 6 7 8 9 10 11-15

Cygnets Date Controls Options



Movie Mode Control

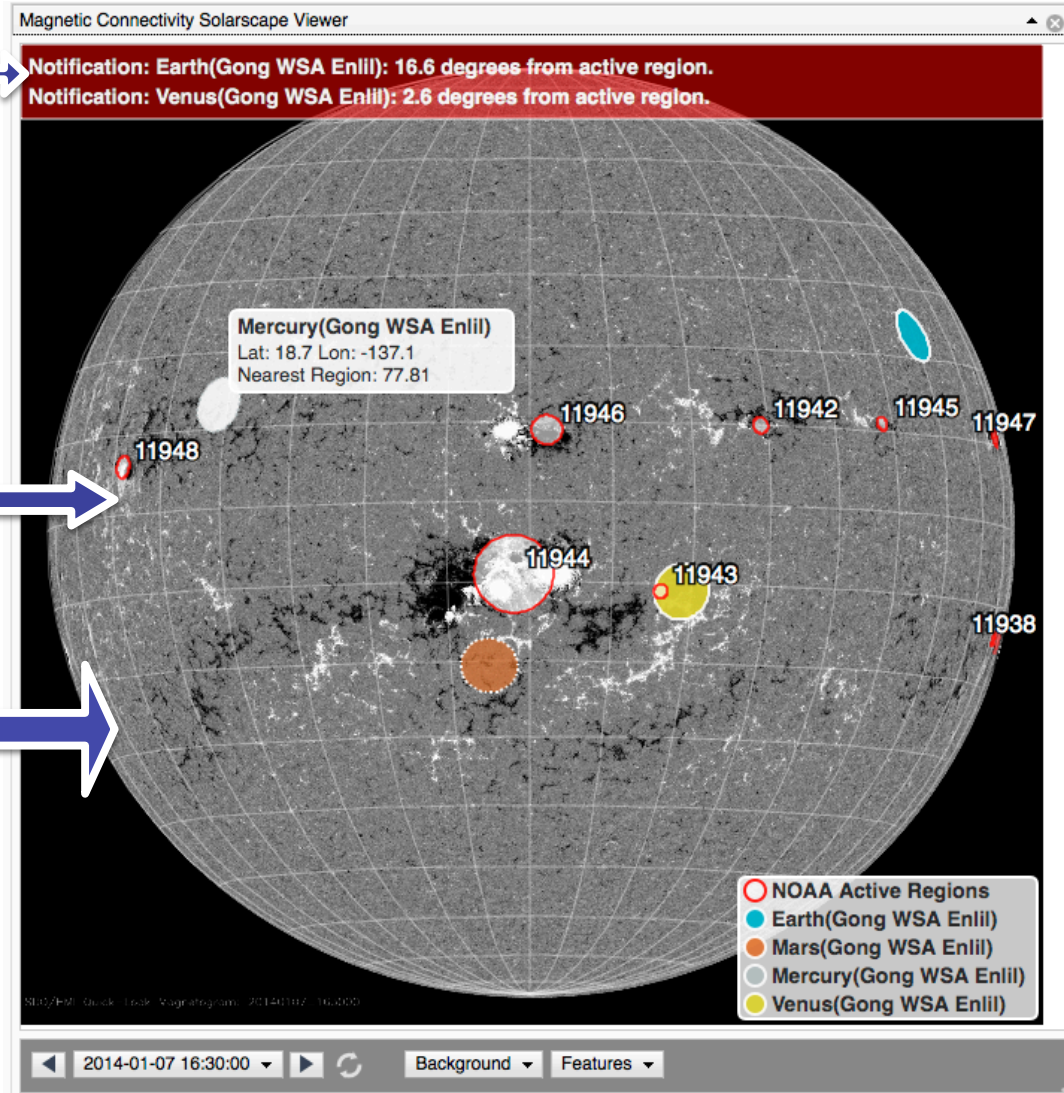
Dynamically Generated & Interactive Products: Solarscape



Alerts/
Notifications

User Selectable Features
(MAG4, NOAA Active Regions,
CCMC Magnetic Connectivity)

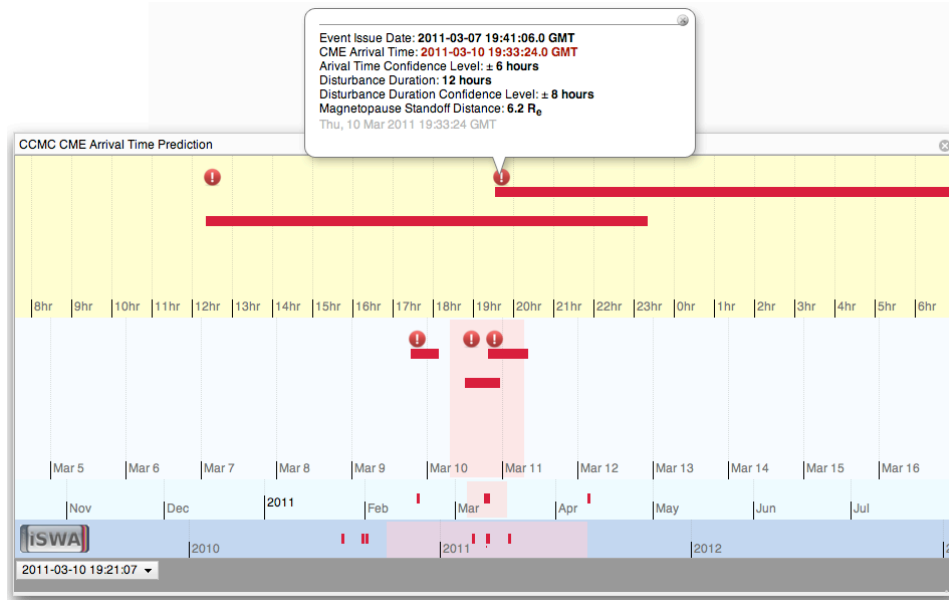
User Selectable Background
(SDO , Generic Grid)



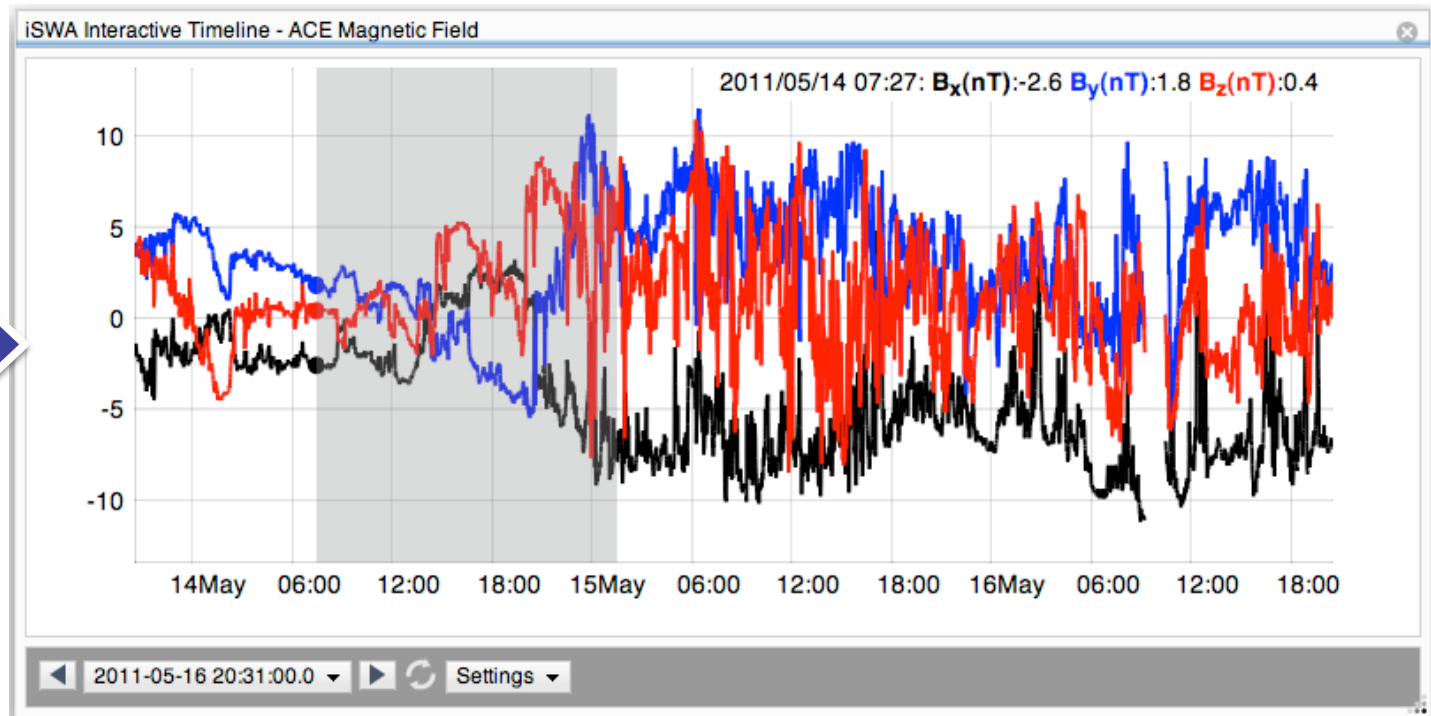
Dynamic Product with User Selectable Features From Several Sources

Interactive Timelines

Interactive CME alert tool with chronological record of SWx Center issued CME time of arrival predictions

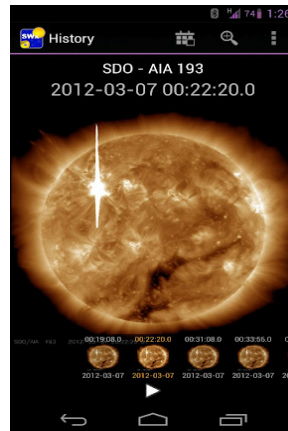
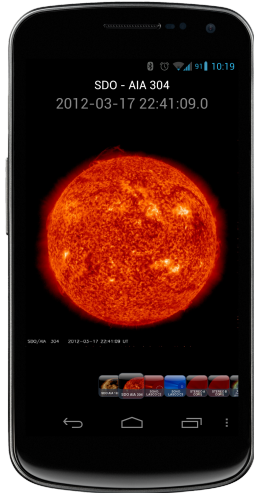


Interactive timeline tool with pan, zoom, mouse-over, and quantity toggling functionality



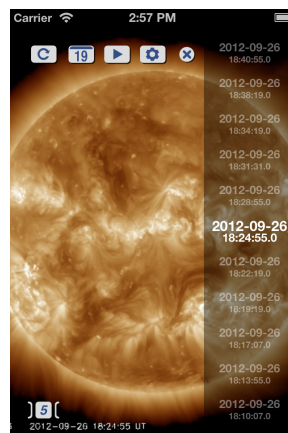
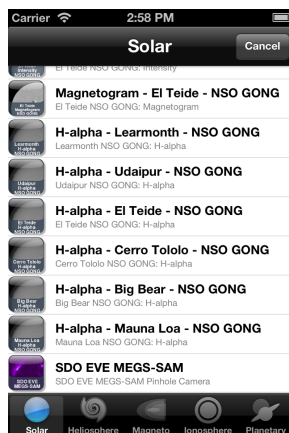


Mobile Access Powered by iSWA



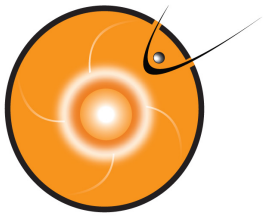
Android Front-End to iSWA

- History Mode
- Movie Mode
- >50k Downloads
- Available in Google Play Store

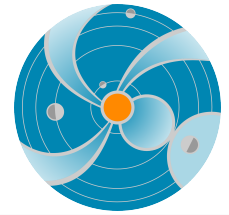


iOS Front-End to iSWA

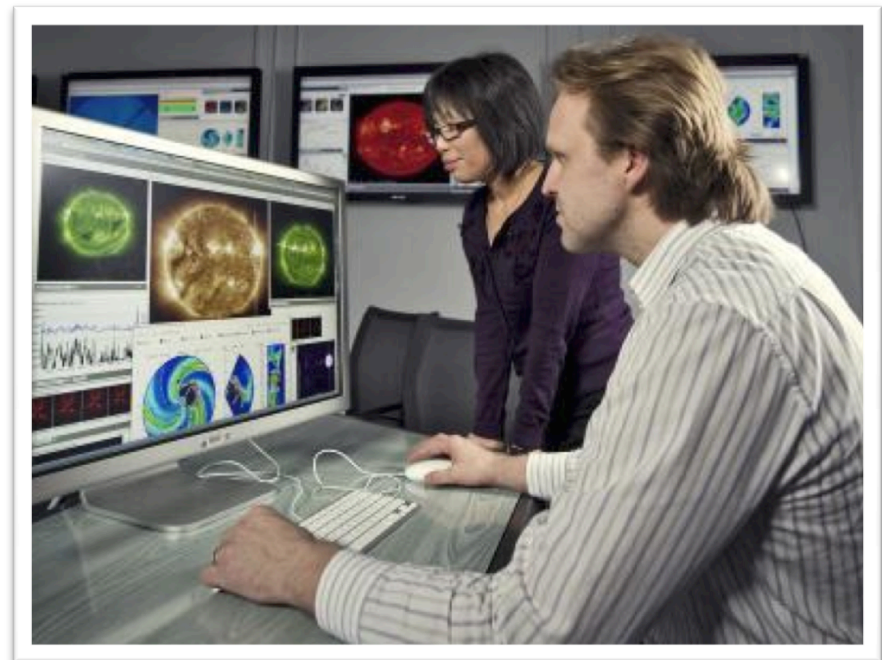
- >100k Downloads
- Available in App Store

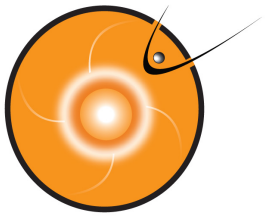


Services for NASA Robotic Missions Powered by iSWA

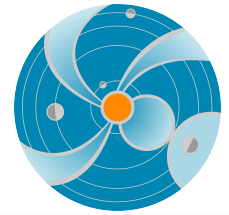


1. Providing assistance in spacecraft anomaly resolution by assessing whether space weather has any role in causing the observed anomaly/anomalies.
2. Sending out weekly space weather reports/summaries to NASA mission operators, NASA officials and involved personnel.



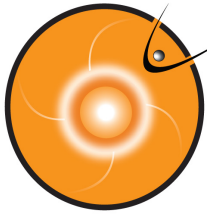


Education And Training Powered by iSWA

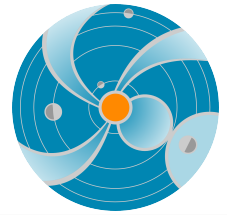


Arranged by NASA IV&V Educator Resource Center
High school teachers from West Virginia

Y. Zheng



Undergraduate Computer Science Interns SW Research Analysis Tool Development Powered by iSWA



Jack LaSota

Web-based CME Analysis Tool

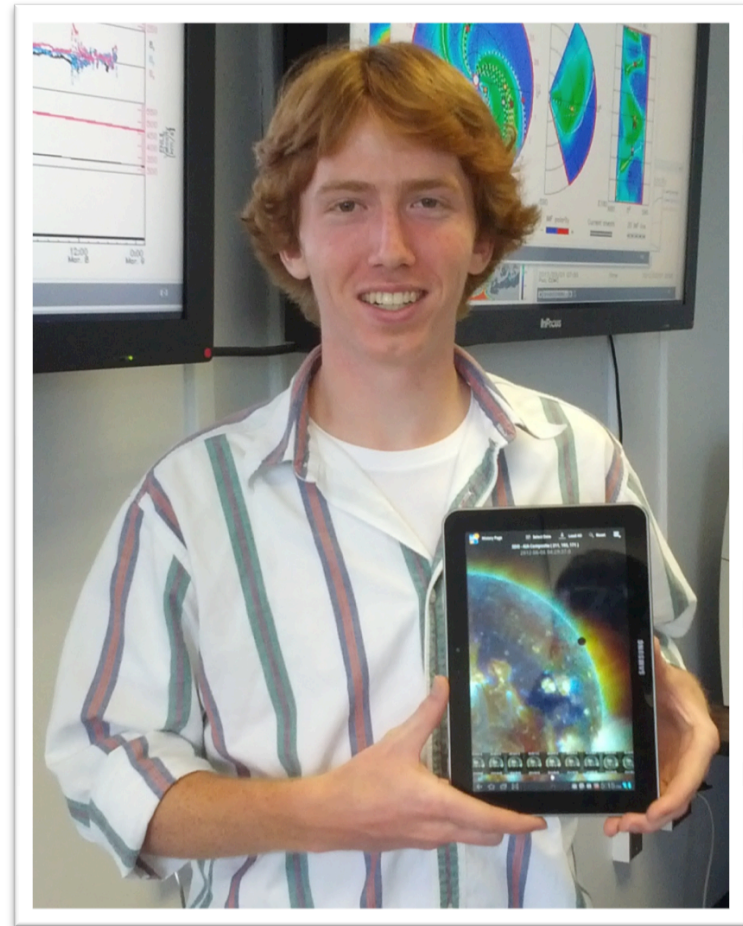


[CME Tool Link](#)

[Sample Analysis Link](#)

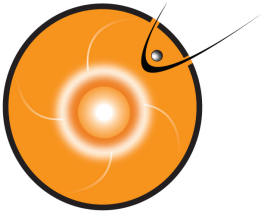
Justin Boblitt

Android iSWA App

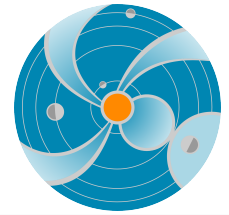


[iTunes Link](#)

[Android Link](#)



iSWA Impact



NASA

- iSWA provides a new capability to quickly assess [past](#), [present](#), and [expected](#) space weather effects.
 - Mission operators have a resource to assist in both anomaly resolution as well as potential space weather impacts.
- iSWA has helped enable the Space Weather Laboratory to establish a new [Space Weather Center](#) service [providing alerts](#), anomaly reports, and weekly space weather summaries based on iSWA tools and products.

External Agencies

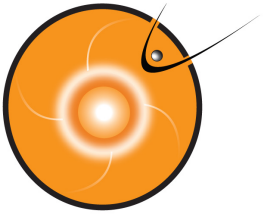
- Agencies can [monitor the iSWA system 24x7 for CME eruptions](#) and notify the CCMC as soon as an event is detected. Forecasters at the CCMC analyze the event and launch a simulation that [estimates the CME arrival time, duration, and expected impact on earth](#).
- iSWA has enabled numerous collaborations with data, model, and product developers/providers who want their tools to be available in iSWA.

Science, Education, and Public Outreach

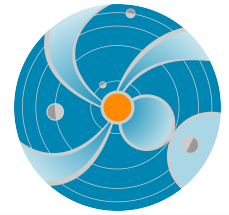
- Researchers, universities, and “citizen scientists” have access to a comprehensive suite of real-time and historical space environment data products.

Who Uses iSWA?





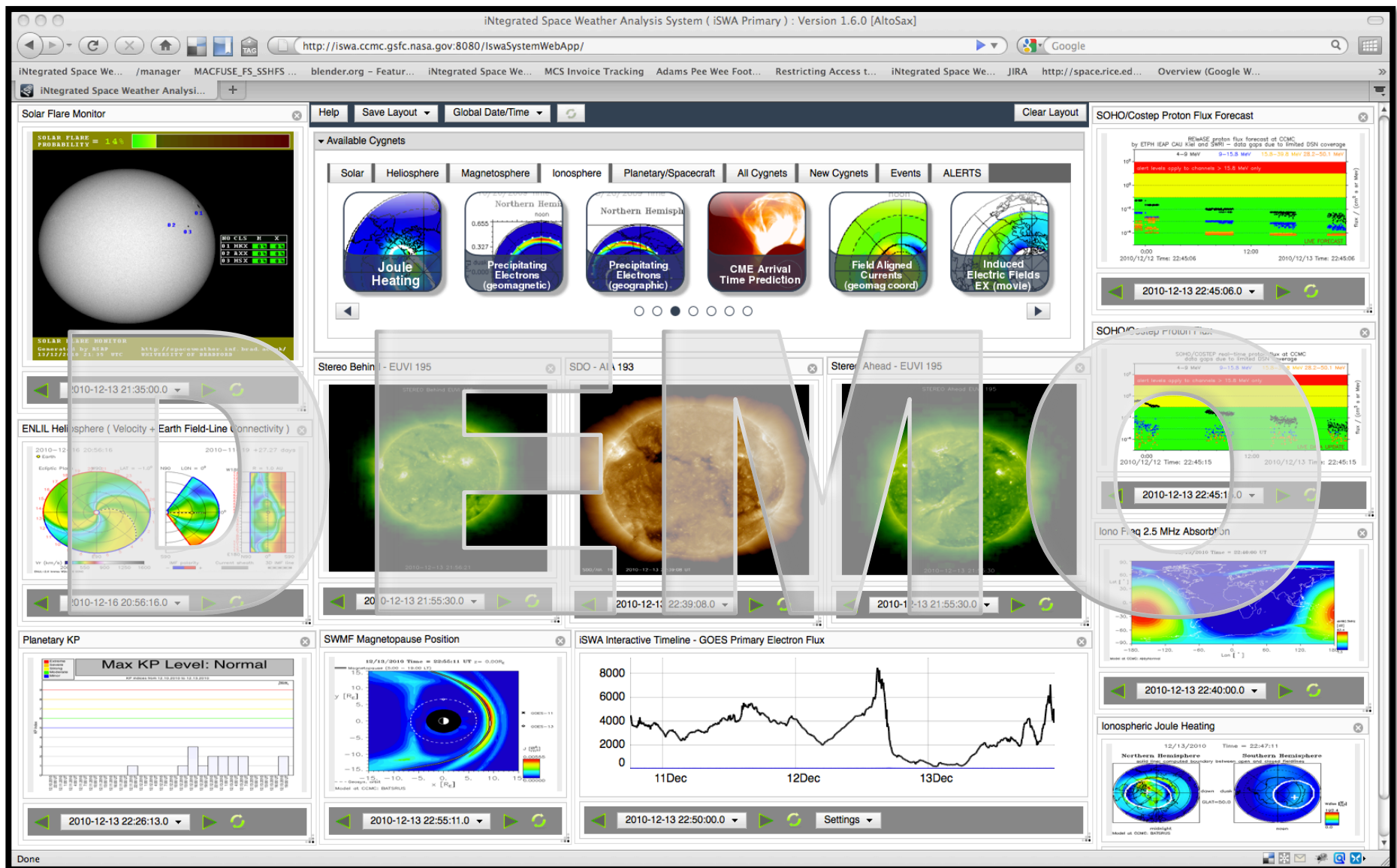
Potential Users



- Any agency, entity, or individual with space weather requirements and/or interests
- Extended educational use (training, K-12, higher education)
- Extended research use (case studies, correlation studies, historical events, general space weather research)

iSWA software can be applied to any agency, group, or project with general data ingestion, storage, management, display, & dissemination needs....

- “instant ground system” for other NASA projects
- turn-key software system for commercial and/or educational data management and dissemination
- customizable interface for existing data archives and sets



<http://iswa.ccmc.gsfc.nasa.gov>